Executive Summary
Greenhouse Gas Emissions Inventory
Summer Internship, 2001
Cities for Climate Protection Campaign
City of Northampton

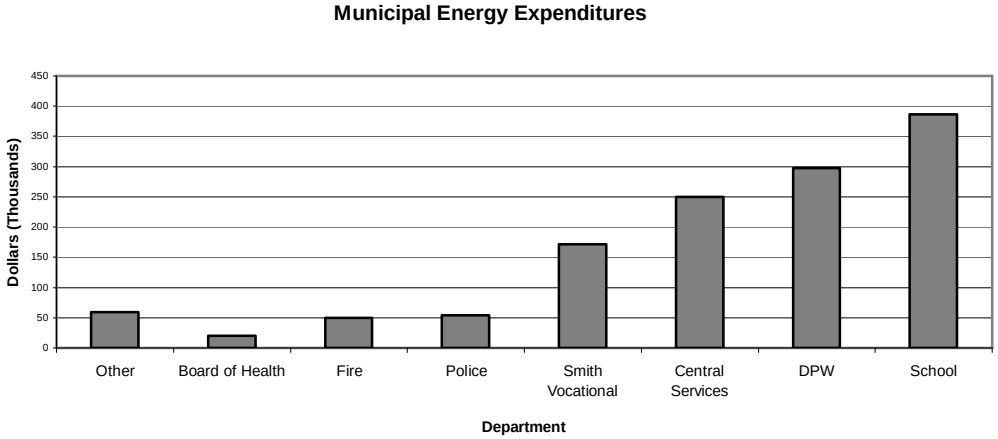
On April 5, 2001, City Council for the City of Northampton voted to join the Cities for Climate Protection Campaign, a project of the International Council on Local Environmental Initiatives.[1] This Resolution recognized the need to address the global warming problem swiftly, effectively, and on a local level. Local governments influence important decisions that affect global warming, such as building and home energy use, transportation, street lighting, and waste disposal (the major sources of urban greenhouse gas emissions). Reducing greenhouse gas emissions not only helps to slow global warming, but it also can lead to substantial cost savings, lessened waste generation, reduced traffic congestion, and increased quality of life in the City. Measures to cut energy consumption can also improve local air quality, thereby lessening local incidence of asthma. Over 75 local governments in the U.S., and over 400 around the world, have joined the Cities for Climate Protection Campaign to reduce their contribution to global warming and are finding the benefits to be real and significant.

The greenhouse gas emissions inventory is the first milestone in the campaign. It is meant to serve as a tool for achieving the other milestones: choosing a greenhouse gas emissions reduction target, and developing, implementing, and monitoring the success of programs under a Local Action Plan. The results of the inventory will give the City a clearer picture of the quantities and sources of greenhouse gas emissions, which will help the City to choose an adequate emissions reduction target, prioritize emissions concerns, and develop effective initiatives.

An inventory was taken for both the municipal and community-wide greenhouse gas emissions in 2000 and forecasted for 2010 from vehicles, waste, and all sources of energy use (electricity, natural gas, and heating oil) in the City of Northampton.

Municipal Inventory Results

Municipal activities play an important role in Northampton's contribution to global warming. Results show that municipal emissions in 2000 account for 3.5**%** of total community-wide emissions. The City spent almost $1.3 million on the electricity, natural gas, and heating oil that emit greenhouse gases.



Most of the emissions came from building energy use (63.3%), which powers things such as electronics, lighting, heating, and air conditioning systems. Building energy consumption cost the City almost $740,000. The water department & treatment plant operations also account for a substantial share of emissions at 16.0%.

[1] The International Council for Local Environmental Initiatives (ICLEI) works with local governments from around the world on local sustainability programs and will provide the City of Northampton with ongoing support, toolkits, case studies, networks, and national conference opportunities. For more information, you can visit *www.iclei.org/co2*.

The vehicle fleet is the City's third largest emissions source (10.9%), producing about 1410 tons of carbon dioxide in fiscal year 2000. Fueling the fleet cost the City over $135,000. The Department of Public Works accounted for over 40% of total municipal expenditures on gasoline and diesel.

Street lights account for 10.3% of municipal emissions. Because of the methane containment system, municipal waste also did not substantially contribute to the City's greenhouse gas emissions.

The breakdown of greenhouse gas emissions by energy type shows that electricity produced 52.3% of municipal emissions and accounted for a whopping 63.4% of municipal energy costs. Natural gas was a distant second at 19.8% of emissions, followed by fuel oil, gasoline, diesel, and propane.

Municipal emissions in 2010 are forecasted to be approximately the same as 2000.

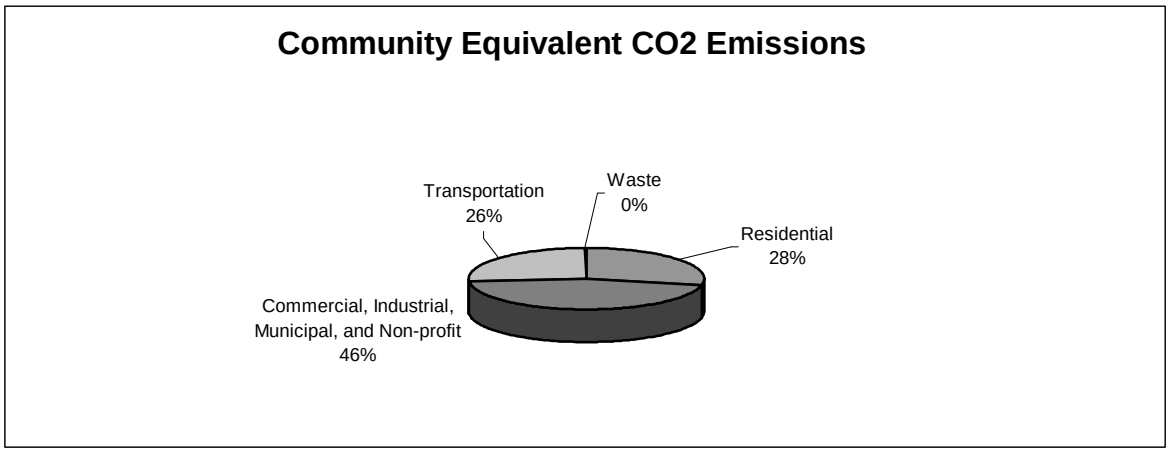
Community Inventory Results

The inventory shows that commercial, industrial, municipal, and non-profit firms are responsible for 45.5% of greenhouse gas emissions in Northampton,[2] suggesting that businesses can gain substantially from improved energy efficiency. Residential energy use accounted for 28.4% of the total.

Transportation is a significant source of community emissions at 26.5%. Transportation emissions are based on vehicles traveling on arterial, collector, and local roads within the City. [3]

Because of the landfill's containment system, there are no greenhouse gas emissions from community-generated waste. The recycling program has further reduced landfill emissions.

Community emissions are estimated to remain roughly the same in 2010. Population, residential energy use, and vehicle miles traveled are projected to remain stable. Waste is expected to increase along with commercial growth and energy use.



Using the Inventory to Take Action

The next steps are for the City to set up a task force, decide on the emissions reduction target for 2010,[4] and put together a Local Action Plan of initiatives to achieve this goal. Northampton has already undertaken several projects to reduce emissions, including installing solar panels at Northampton High School, promoting carpooling with an online bulletin board, and making the streets safer for bicyclists and pedestrians. The Local Action Plan should expand on existing projects and suggest new opportunities for reducing energy consumption. It can include opportunities for educational outreach, incentive-based programs, regulations, and municipal projects. For each program, the plan should specify who will take ownership, when implementation should be completed, and what the expected costs and benefits will be.

[2] Due to a lack of up-to-date, readily available information, heating oil estimates are based on state averages adjusted for local conditions.
[3] All vehicles are included, regardless of ownership (residents and non-residents, commercial and municipal, etc.)
[4] ICLEI suggests a target reduction rate of 20% by 2010, although other cities have adopted more or less aggressive goals.

Northampton CCP Goals and Objectives

Overall Goal:
To reduce the emissions of gases and air pollutants that contribute to global climate change and local air quality degradation.

Northampton Specific Objectives:
1) Improve and protect Northampton's quality of life in the future.
2) Raise awareness of global climate change and the sources of climate changing gases.
3) Implement public programs to increase energy and transportation efficiency as well as solid waste reduction in order to reduce the contribution of the Northampton community to the global problem of climate change.
4) To develop practices to reduce the emissions of greenhouse gases and increase operational cost efficiency in municipal operations.

Introduction

There is a scientific consensus that human emissions of "greenhouse gases," primarily carbon dioxide and methane, are having a measurable effect on the Earth's climate. While the exact effects of elevated levels of greenhouse gases are difficult to predict, it is recognized in the international scientific and political community that we will face alterations in weather patterns, ocean behavior, and biological processes if action is not taken. The effects on residents of Northampton may include: increased severe weather events; reduced air quality; increased health problems and emergency room visits due to elevated summer temperatures; spread of mosquito and tick-borne diseases such as malaria, encephalitis, and Lyme disease; loss of urban forest habitats; threats to water quality; and changes to many of New England's natural resources, including the sugar maple.

Scientists have been researching the phenomenon commonly referred to as the greenhouse effect for decades. There has been growing scientific consensus that although the exact effects are difficult to predict, the increased level of CO_2 and other greenhouse gases in the atmosphere will cause changes in the Earth climate systems. Human industrial activity has contributed to a 30% increase in global CO_2 level through the combustion of fossil fuels for energy. Other anthropogenic contributions of greenhouse gases include the production of methane in waste disposal, the emissions of nitrous oxides, and the manufacturing of chloroflorocarbons.

An increase in greenhouse gases can have a dramatic effect on the Earth's atmospheric behavior. The term global climate change is used to refer to the diverse array of potential alterations in the planet's physical and biosphere conditions. A slight overall warming of the Earth surface may be accompanied with an increase in severe weather events such as storms and droughts, geographic shifts or losses of ecosystems, changing ocean patterns, reduced polar ice caps, and alterations in regional agricultural productivity.

In Massachusetts, the average temperature has increased by 2% over the past century and precipitation levels have risen by up to 20% in many regions of the Commonwealth. This trend is expected to continue through the next century with an expected four degrees Fahrenheit increase in winter and spring temperatures and 5 degrees Fahrenheit in the summer and fall. Increased heat waves will elevate heat-related deaths particularly in urban areas such as Boston. Ground level ozone level will rise, reducing air quality. The Massachusetts human population will likely face a combination of elevated populations of disease carrying insects such as mosquitoes and ticks, with growing range of infectious diseases usually found in tropic areas, such as encephalitis and malaria.

Sea levels in Boston have risen 11 inches in the last century and this trend is expected to accelerate. More frequent heavy storm events are expected to bring an increase in rain and snowfall. Changes in weather patterns will affect our water resources including increased flooding in spring, water scarcity in summer and greater threats to water quality. Natural habitats and resources such as forest, fisheries, and agricultural lands will be faced with increased stresses.

Global climate change is an issue that needs to be addressed at every level of government and society. International treaties are in negotiation, federal and state studies have been conducted, and local governments have begun taking actions. The objective of Local Agenda 21 of the Kyoto Protocol asks municipal governments to work on local emission reduction plans. Energy consumption and waste disposal policies can often be most effective at the local government level and action can be taken most quickly. It is the hope of this campaign that the collective efforts of many communities can have a significant impact on this global problem.

ICLEI and Cities for Climate Protection

In April of 2001, Northampton City Council voted to participate in the Cities for Climate Protection Campaign, a program of the International Council on Local Environmental Initiatives (ICLEI). ICLEI is an international non-profit working to address global environmental concerns through local sustainability programs. ICLEI began its work 10 years ago to coordinate efforts by communities and to provide technical assistance for local environmental planning. In 1993, ICLEI began the Cities for Climate Protection Campaign to assist local governments addressing rising emissions of greenhouse gases. Currently, over 400 municipalities worldwide and over 100 in the U.S. are participating in the CCP Campaign. Participating communities in the U.S. represent an estimated 8% of total greenhouse gas emissions from this country.

This emissions inventory is the first step in Northampton's efforts to address global warming pollution at the local level. The goal of the inventory is to guide Northampton's process of writing and implementing a plan of actions to reduce the emissions contributing to climate change. By first knowing the relative sources of greenhouse gas emissions, Northampton will be better equipped to strategically and cost-effectively reduce emissions. It is less costly, politically and financially, to reduce greenhouse gas emissions today than to deal with climate change in the future.

The Cities for Climate Protection Campaign involves a Five-Milestone process. At the time of this report, Northampton has completed Milestone One.

- **Milestone One:** Conduct a baseline emissions inventory for the entire community as well as municipal operations. The emissions growth or decline by the year 2010 was projected from this baseline data, assuming that no actions are taken to address greenhouse gases. The primary emission sources examined in the Milestone One Inventory are:
  Energy Use - electricity and heat for residential, commercial and municipal facilities
  Transportation - emissions from personal & commercial vehicles and transit vehicles
  Solid Waste - methane and CO_2 contribution of waste disposal operations

- **Milestone Two** - Set an Emission Reduction Target. Many local and international targets have been set at 20% of the base year emissions level, and use their projection year as the goal for obtaining these emission reductions.

- **Milestone Three** - Develop an Action Plan - a collection of initiatives to reach the emission reduction target. These initiatives will include finding efficiency and technological improvements available to the city operations as well as encouraging emissions reductions within the community.

- **Milestone Four** - Implement Actions. Various initiatives may require decisions and efforts by municipal program departments and operators, City Council, local businesses, and residents.

- **Milestone Five** - Monitor Emissions Reductions. Set annual goals for policy implementation and calculate emission reductions from policies put into place.

There are eight other municipalities in Massachusetts that have joined the Cities for Climate Protection Campaign: Amherst, Springfield, Watertown, Arlington, Boston, Cambridge, Medford, and Newton.

Emissions Inventory and Forecast Methods

Overall Inventory Methods

The baseline year for the Northampton greenhouse gas inventory was 2000. This was the earliest year for which reliable data could be generated. Trends and data from throughout the 1990's were collected and used occasionally in this report. The year 2010 was chosen to project future emissions forecasts and emissions reduction targets.

The emission inventory and forecast, as well as most of the reduction measures, are separated into two distinct areas. The first is a community wide assessment of all energy and waste related activities that occur in the City of Northampton. The emissions data includes emissions from within the City's borders such as vehicle tail pipes, heating boilers, and waste disposal. Emissions from electricity generation occurring outside of Northampton but providing power for activities within the city are also included. The second section of the inventory is an evaluation of emissions coming from City government operations. This includes building energy use, vehicle fleet emissions, municipal solid waste, and other energy use such as outdoor/street lighting and water works operations.

A separate municipal inventory was conducted because the city government ultimately has greater control over its own emissions than over private activities in the community. The City can contribute directly to emission reductions through its own practices while setting an example for responsible energy and fuel use for residents and institutions within the community. For the most part, government operations that are not directly controlled by city government (i.e., county and state governments) as well as energy use by contractors working for the City of Northampton are not included in this inventory.

The inventory required data and technical information to be collected from a wide range of sources, including:

- City of Northampton Offices: Mayor’s Office, Department of Public Works (including the Treatment Plant and Water Department), Building Commission, Planning Department, Board of Health, Central Services, Recreation Department, Assessor's Office, Fire Department, Police Department, School Department, and Libraries;
- Federal Agencies: Bureau of the Census, Department of Energy;
- Local Utilities: BayState Gas, Massachusetts Electric Company, Whiting Energy Fuels, Global Oil, Country Oil;
- Commissions and Non-Profit Organizations: Center for Ecological Technology, Pioneer Valley Planning Commission.

(A list of contacts for the offices providing data for this inventory can be found in Appendix A)

The data gathered from these offices was entered into specialized software designed by ICLEI and Torrie Smith Associates. The CCP software calculates equivalent carbon dioxide emissions (eCO2) from energy use and other inputs. It also translates all energy units into British Thermal Units (BTUs) for comparison between energy sources. For the Municipal inventory, operational costs were included in the data and inventory reports.

Residential Homes

To measure residential emissions contributions within Northampton, the consumption of electricity and heating fuels by customers was calculated. Electricity and natural gas data was collected from local utilities. Heating oil use was estimated using a methodology described below. Nancy Nylen from the Center for Ecological Technology provided residential electrical consumption data, which she had obtained from the Massachusetts Electric Company (MECO). The KWH consumption was multiplied by a Massachusetts based CO_2 coefficient provided by ICLEI according to the Commonwealth's electricity generation profile. Brian Errante in the Sales Office of BayState Gas provided natural gas consumption for 2000. The population growth rate was used to project forward to 2010.

The number of residential consumers is very different between the two utilities. BayState Gas considers apartment buildings residential if each apartment has a separate account. MECO has a larger number of residential accounts because electricity is easier to meter for individual apartments in large buildings. The MECO accounts are divided according to rate classes: residential, commercial, and streetlights.

Heating oil is not provided by one utility, but by several dozen independent heating oil distributors in the Northampton area. Because of the difficulty of obtaining data from each vendor, heating oil consumption was estimated using information from the Department of Energy and census data.[5] With 1990 Census data, usage was calculated by multiplying proportion of Massachusetts homes being heated with oil in Northampton by total state usage in 1999. This figure was then adjusted for Easthampton heating degree-days. Heating oil use is not adjusted for square footage or building age.

The fuel mix is not projected to change significantly because BayState Gas is only extending gas lines for major developments. Its marketing is targeted at low-use customers and non-gas residences on existing lines. Population is not expected to grow in Northampton, although the number of households has increased slowly.

Commercial and Industrial Operations

Commercial figures include municipal, non-profit, commercial, and industrial energy consumption. The process for calculating emissions for commercial and industrial establishments was similar to that of residential housing. Nancy Nylen of the Center for Ecological Technology provided commercial/industrial electrical consumption for 2000. Street lighting electricity use is billed at a different rate than other accounts and was listed separately from commercial use. The municipal street lighting account was added to the commercial electricity use data. All other city government electricity use is embedded within the commercial account data. Brian Errante of BayState Gas provided natural gas consumption for 2000. The municipal natural gas use is tallied within the BayState Gas commercial account data. Projections are based on commercial growth for 2010.

Square footage data was inaccessible for industrial and commercial establishments. Heating oil, propane, coal, and wood consumption was based on the percentage of total Massachusetts

[5] Most inventories calculate heating oil consumption by multiplying total residential square footage data by a regional average of residential oil consumption per square foot (0.374 in New England). Although data from the Assessor's Office on square footage was available, the estimate generated from this data was very low. This is probably due to the lack of information on apartment buildings in Assessor’s data.

employment that is based in Northampton, the number of heating degree days in Easthampton, and state-wide commercial and industrial energy consumption for each fuel. The commercial and industrial figures were then combined, to be consistent with data collected on electricity and natural gas. Heating oil use is not adjusted for square footage or building age.

Transportation Methods

Emissions from personal and commercial vehicles (including automobiles, motorcycles, light and heavy trucks) was calculated using daily Vehicle Miles Traveled (VMT) data generated by Dana Roscoe of the Pioneer Valley Planning Commission. Mr. Roscoe used a transportation system model based on regional mobility studies from 1997. The daily VMT was multiplied by 330 to account for traffic volume changes on weekends and holidays.[6] The national average data for vehicle fuel efficiency provided by the software was used to calculate fuel use. Interstate 91 was excluded from total VMT to capture emissions under the City's jurisdiction. Local road VMT was estimated to be 17.5% of total arterial and collector VMT, based on NY's Capitol District Transportation Committee's estimate of 10% of total VMT, including interstates (contact: Chris O'Neil at (518) 459-2155).

Public transportation was not included in the daily VMT figure. Additional data should be collected to account for fuel consumption by buses.

Solid Waste Disposal

All residential and municipal solid waste collected by the city is taken to the Northampton landfill. Municipal, non-profit, commercial, and industrial waste was combined for entry into the software. Commercial and Industrial waste is assumed to be 50% of total waste, per Karen Bouquillon of the Board of Health. Residential trash figures were doubled to account for subscription haulers. Peter McErlain of the Board of Health provided the landfill's methane recovery rate.

[6] Using 330 takes into account the presence of some traffic outside of business hours.

Municipal Emissions Inventory Methods

Summary
The Municipal GHG Inventory was conducted using fiscal year 2000 data rather than the calendar year. Much of the data needed for the Municipal GHG Emissions inventory was available in Memorial Hall, due to previous efforts by Central Services to provide usage information to a competing electricity vendor. A great deal of energy use information on School Department usage for 2000 and 2001 was already being aggregated by Central Services. However, data for most years and most departments is highly decentralized. The City should develop a system of reporting utility bills to facilitate future data collection on energy usage.

Buildings
Several departments complete energy use reports that record their monthly consumption and expenditures for electricity, heating oil, and natural gas. However, there were too many gaps in the data to rely solely on these reports. Individual department records were consulted to complete the building emissions inventory as well as confirm aggregated data. Individual departments provided energy use reports or utility billing information:

Peter McErlain – Board of Health
Ray Ellerbrook – Recreation Department
Laura Krutzler – Fire Department
Regina Drozdal – School Department
Lisa Rehbein - DPW
Susan Stone - Central Services
Jane Hounshell- Police Department

City-supported, but not city owned, buildings (the libraries) were included in this report. City-owned but not operated buildings (Florence Community Center, Survival Center, and the Masonic Street shelter) were also included in the municipal inventory data, despite semi-independence from the municipal government. This information is relevant for discussion of municipal emission sources to help the city prioritize buildings to retrofit and/or sell. Public housing energy use data was not available at the time this report was written.

Energy use data were available in the different forms. Electricity cost information includes interest charges. However, gas and heating oil charges are based on current usage only (i.e., they do not include interest charges).

Forecasts for building energy use were assumed to be constant. This assumes no dramatic changes in winter heating or summer cooling needs. Additionally, increases in electricity use due to continued expansion of information or office technology are not considered.

Vehicle Fleet
Vehicle fleet fuel consumption was calculated on a departmental inventory of fuel purchases. Usage and cost information was gathered from billing reports obtained from Laura Brzys of DPW. All fuel is obtained from the DPW yard tanks with two regular exceptions. The fire department has its own diesel fueling station for fire trucks, and flood control has separate unleaded gas and diesel tanks. Cost estimates for DPW's own gasoline consumption was estimated at $1.15/gal (an average of cost paid by the other departments). DPW's diesel expense was estimated at $.90/gal.

Fuel use by employees reimbursed when using personal vehicles for city business is not included in this inventory. The forecast for FY2010 assumed no change in vehicle use or fuel consumption by

the city. Therefore, the FY2010 forecast data is unchanged from FY 2000. Vehicle emissions from City operations that are contracted out to private contractor for work such as construction projects are not incorporated in this study.

Street Lights
Streetlights, parking lot lights, traffic signals, and area lights within parks are included in this category (all S-rate accounts). The data for electrical use of these different street lighting accounts was obtained from Central Services files. Sue Stone of Central Services provided information on the end use of each electricity account (e.g., building lighting, outside lights).

Solid Waste
Waste generated in municipal buildings is sent to the Glendale Road landfill. Karen Bouquillon of the Board of Health estimated municipal waste by multiplying the number of employees by an estimated amount of waste per person and adjusting for 250 working days in the year.

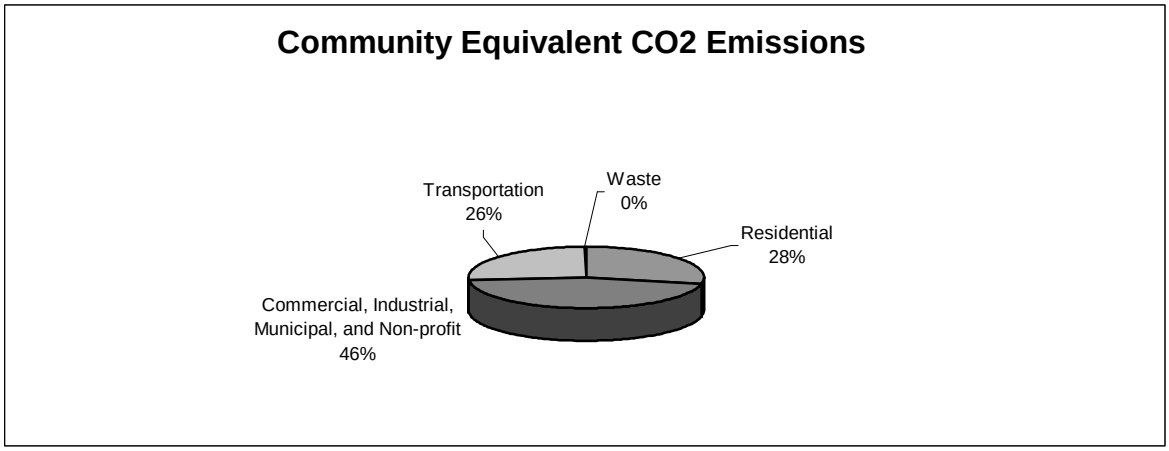
Water and Treatment plant
Energy usage and expense for the Water and Treatment Departments of the DPW were included in this category.

Community Emissions Results

Summary

The City of Northampton produced 372,363 tons of eCO2 in the year 2000. Total residential household energy use (includes electricity, natural gas, and heating oil use) accounted for 28.4% of these emissions. Municipal, industrial, non-profit, and commercial enterprises consumed 45.5% of the community's emissions. The other major contribution came from the transportation sector, which generated 26.5% of the city's emissions. The four largest single sources of greenhouse gas emissions were commercial electricity use, vehicle gasoline consumption, residential electricity use, and commercial natural gas consumption, in that order.

It is forecasted that without any action to reduce greenhouse gas emissions, Northampton will be responsible for 381,110 tons of eCO2 production in the year 2010, an increase of 2% over the baseline emissions.



Northampton Community Emissions by Source

eCO2 Source	eCO2 (tons) 2000	Energy (mil BTUs) 2000
Electricity	172165	823086
Natural Gas	58180	984821
Heating Oil	40142	507942
Gasoline	88324	1060987
Diesel	8827	107283
Other	4725	240037
Total	372363	3724156

According to the US Census, the City of Northampton has a population of 28,978 in 2000. The City of Northampton Planning Department does not expect population to grow significantly by the year 2010, although the number of households will probably increase. In the base line year, Northampton's per capita eCO2 emissions equaled 12.8 tons of eCO_2 per person. Compared to other municipalities of its size that have conducted a similar greenhouse gas emissions inventory, Northampton's emissions are in the middle of other cities and towns in northern climates. Northampton is an older community that is somewhat built out and should not expect significant

growth in population. Therefore, eCO_2 emissions should not rise drastically unless there is an increase in per capita energy consumption or accelerated personal vehicle use. The City of Northampton should be able to take action to reduce its total eCO_2 emissions below the 2000 baseline level by the year 2010.

CITIES FOR CLIMATE PROTECTION CAMPAIGN (CCP)
COMMUNITY PER-CAPITA BASELINE INVENTORY EMISSIONS COMPARISIONS

City or Town	Population	GHG Emissions (tons eCO2)	Per Capita (tons/person)	Baseline Year for Inventory
Santa Fe, NM	55,859	1,418,819	25.4	1990
Newton, MA	82,585	1,973,540	23.9	1990
Watertown, MA	33,284	695,675	20.9	1999
Fort Collins, CO	87,758	1,673,861	19.1	1990
Augusta, ME	18,553	349,552	18.8	2000
Saratoga Springs, NY	26,186	470,135	18.0	2000
Fairfield, CT	53,000	921,584	17.4	1994
Cambridge, MA	95,802	1,695,117	17.7	1990
New Haven, CT	123,626	2,026,201	16.4	1999
Nashua, NH	86,605	1,301,817	15.0	2000
Northampton, MA	28,978	395,335	13.8	2000
Santa Cruz, CA	54,575	747,679	13.7	1990
New Rochelle, NY	72,182	985,112	13.6	2000
Buffalo, NY	309,035	3,966,716	12.8	1999
Medford, MA	57,400	696,112	12.1	1995
Gloucester, MA	29,456	351,908	11.9	1998
Brookline, MA	54,718	626,512	11.4	1995
Burlington, VT	39,127	438,931	11.2	1990
Amherst, MA	34,874	380,904	10.9	1997
Somerville, MA	77,098	751,729	9.8	1997
Arlington, MA	43,835	335,063	7.6	1997
County				
Suffolk County, NY	1,419,420	35,500,392	25.0	2000
Tompkins County, NY	96,500	1,384,209	14.3	1998
Westchester County, NY	905,572	11,943,626	13.1	1999
State				
New York State	18,976,457	223,495,800	11.8	1999
New York State	18,976,457	223,660,800	11.8	1999

Residential Energy Use Results

The residential sector energy use was the second largest contributor to greenhouse gas emissions. About 50% of these emissions came from electricity use and another 27% from oil heating. Natural gas use will likely increase marginally by 2010, and oil use will probably decline as homeowners replace old boilers with natural gas furnaces or higher efficiency oil ones. Data showing these broad trends locally were not available, so increases in energy use were based on growth in the number of households.

Weather is also a significant factor when considering home energy use. According to the U.S. Census data, in 2000 Easthampton had a total of 5754 heating degree-days, and 751 cooling degree-days (a degree-day is a unit used to measure building energy needs). Degree-days are calculated with the summation of degrees Fahrenheit each day that the average temperature is below or above 65 (e.g., one day with a high of 90 degrees equals 25 degree-days).

Greenhouse Gas Emissions by Sector

Year	Residential (Tons eCO_2)	Commercial (Tons eCO_2)	Transportation (Tons eCO_2)	Waste & Sewage (Tons eCO_2)
2000	105674	169480	98796	-1587
2010 (forecast)	107736	177347	97825	-1797

Commercial and Industrial

The commercial sector was the largest contributor to greenhouse gases in Northampton, generating 169,480 tons of eCO_2 in 2000. Electricity use of commercial, industrial, non-profit, and municipal accounts was the highest single source of eCO_2 and resulted in 32% of all City emissions.

The City of Northampton accounts fall under commercial use and the municipal operation contribute nearly 12,978 tons of eCO_2, or 7.6% of the commercial emissions.

The high levels of emissions from electricity use in the community, both residential and commercial, point to two opportunities for the City's emissions reduction action plan. The first is aggressive energy conservation and efficiency efforts in institutional buildings and homes. The second is developing a block electricity purchasing account in order to transfer a large portion of the City's electricity demand to cleaner energy sources.

Transportation Results

Vehicle miles traveled in Northampton was in excess of 165 million miles. This corresponds to about 372,000 tons of equivalent CO2 in 2000. Northampton's automobile traffic is not forecasted to grow by 2010.

Solid Waste and Sewage

All residential and municipal solid waste collected by the city is taken to the Northampton landfill. Municipal, non-profit, commercial, and industrial waste was combined for entry into the software. Because the landfill has a high methane recovery rate, the community’s contribution of waste-related greenhouse gas emissions is negative (-1587 tons of equivalent carbon dioxide). The organic matter in the landfill would have created uncaptured greenhouse gas emissions if it were disposed of elsewhere.

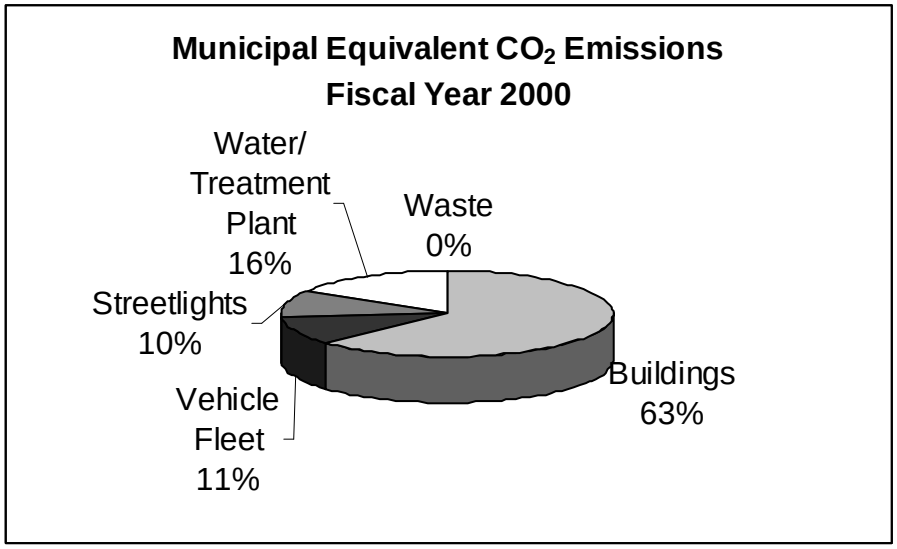
Municipal Results

Summary

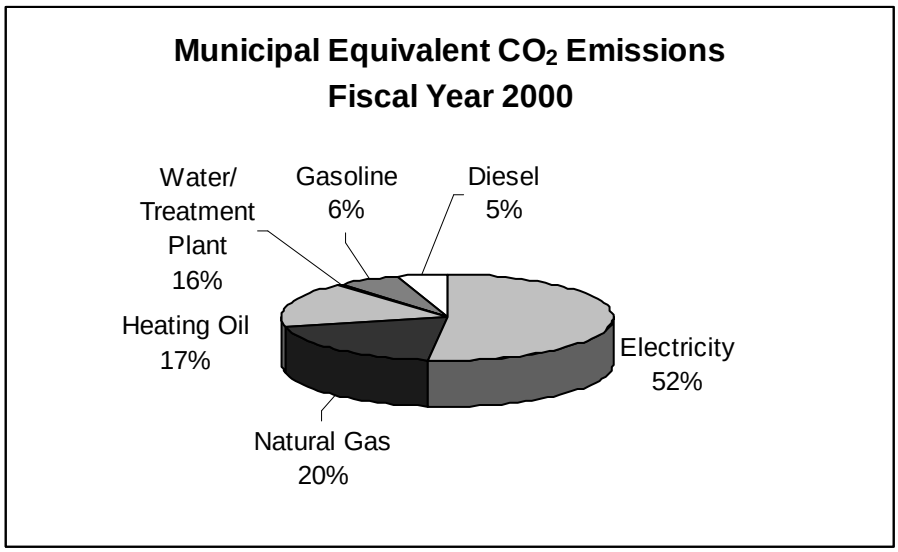
The results of the municipal inventory are based on the fiscal year, which runs from July 1st to June 30th. The City of Northampton generated 12,978 tons of eCO_2 in the fiscal year 2000. Buildings accounted for approximately 63.3% of the city's emissions. The Water and Treatment Departments and the vehicle fleet were the next two largest contributors. The energy source responsible for the greatest percentage of emissions was electricity use, at 52.3% of total municipal emissions. Natural gas was the second greatest contributor. The City operations represent 3.5% of the community's net eCO_2 emissions. The city's contribution is not expected to grow by 2010; however, more research should be done to verify a growth rate.

FY00 Municipal Greenhouse Gas Emissions by Sector

Sector	Buildings	Vehicle Fleet	Streetlights	Water/ Treatment
Tons of eCO2	8,218	1,410	1,338	2,077



Many department and division leaders have already begun work towards energy efficiency or fuel emission reductions. Central Services is actively installing energy efficiency lighting and researching municipal energy use, especially in school buildings. The Board of Health has actively promoted solid waste recycling and has researched methane conversion for the Glendale Road landfill.

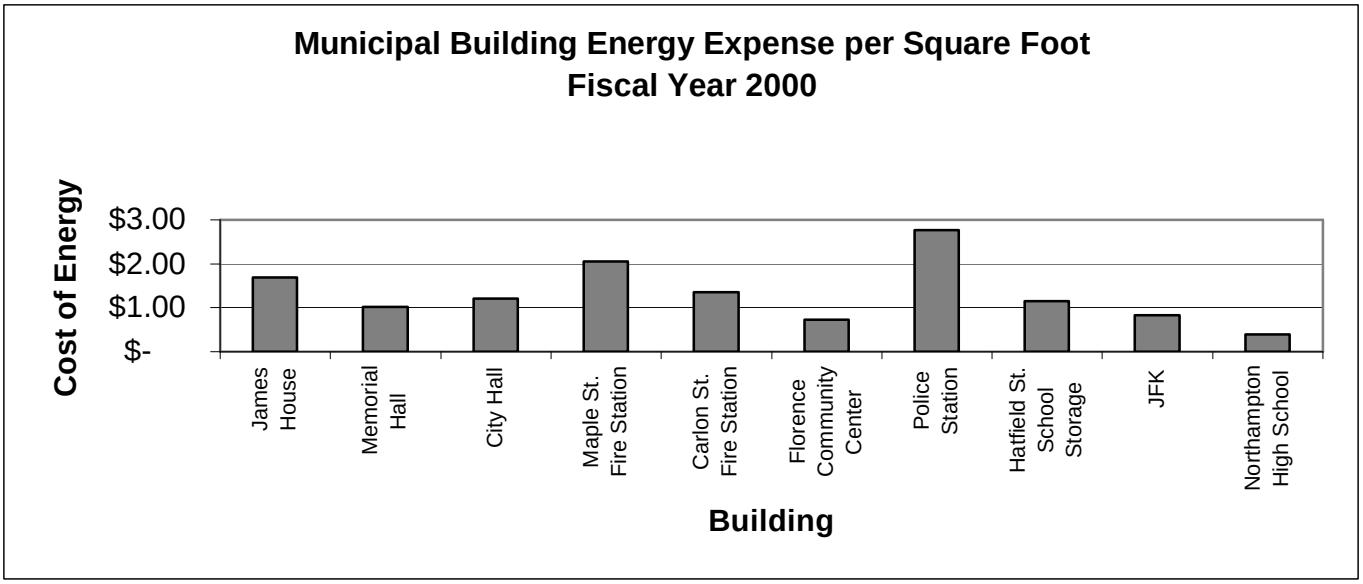


Source	Energy (mil. BTUs) FY00	Energy Expenditure FY00
Electricity	32440	$815,105
Natural Gas	43447	$197,363
Heating Oil	28051	$130,701
Gasoline	9418	$85,420
Diesel	7613	$49,772
Propane	926	$7,156
Total	121896	$1,285,517

Buildings

The City's buildings are the largest contributor to greenhouse gases within the municipal inventory. Collectively buildings contributed 8,218 tons of eCO_2 in fiscal year 2000. The cost for energy use in all city buildings was $737,320 in 2000. Electricity use was the largest source of greenhouse gas emissions in the City buildings.

The JFK school building incurred the highest total energy expense in 2000 at $118,045. Northampton High School had the second largest energy expenditures that year, $82,888. Square footage information was available for a number of buildings. Energy use per square foot was calculated for those buildings that have heating oil, gas, and electricity accounts that are independent of other buildings. Although Northampton High School had a high total energy expense, its cost of energy per square foot, $.39, was well below the average for buildings included in this sample, $.89.



The city's plan to sell the Masonic Street Fire Station and move School Department administration into Memorial Hall will undoubtedly have an effect on overall emissions due to building energy use in the future. Continued efforts by Central Services to cut energy expenditure will have a similar effect. However, these efforts were not included in the municipal forecast because of the difficulty in measuring impacts and/or the tentativeness of the plans.

Vehicle Fleet

The City's vehicles consumed 129820 gallons of unleaded fuel and 74939 gallons of diesel fuel in FY00, resulting in the production of 1410 tons of CO2. The fuel for the vehicle fleet cost the city $135,245 for gasoline and $85,420 for diesel.

Fuel Use by Department

(BTU - Unit for combination of diesel and unleaded fuels)

Department	FY00 Million BTU	Fuel Cost ($)	CO2 (tons)
DPW	8069	57861	666
Fire	1121	9115	93
Housing Authority	662	5636	52
Parking Garage	128	1195	11
Police	4251	38191	354
School	1542	12624	128
Smith Vocational	1092	8812	90
Other	166	1758	16
Total	**17031**	**$135,192**	**1410**

Street Lights

Streetlights include actual streetlights and signals, parking lot lights, and area lights within parks.

Lighting Type	FY00 Million BTU	FY00 eCO2 (tons)	Cost
Parking Lot Lights	1534	321	$32,248
Recreation/Other	37	8	$1,511
Signal Lights	502	105	$16,271
Street Lights	4325	7	$155,440
Total	**6398**	**1338**	**$205,471**

Solid Waste

Municipal waste goes to the Glendale Road landfill. The landfill has a high methane recovery rate, 75%. Because the organic matter in the landfill would have created uncaptured greenhouse gas emissions if it were disposed of elsewhere, the landfill's contribution to global warming is negative (-66 tons of equivalent carbon dioxide).

Greenhouse Gas Emission Reduction Measures

Introduction

The next step for the City of Northampton is to set an emissions reduction goal. ICLEI suggests a target reduction rate of 20% below the 2000 levels by the year 2010. Other cities have adopted more or less aggressive goals, with varying target years and reduction amounts. For example, Burlington, VT set a reduction goal of 20% by the year 2005.

After setting an emissions reduction target, the City can use the inventory data to draft a Climate Protection Local Action Plan. City Council, the responsible City department, and/or an appointed climate protection task force could write the action plan. Northampton should establish departmental ownership of this initiative so that proposals are evaluated with administrative and technical expertise. A well-staffed climate action task force can be highly effective in maintaining project momentum and suggesting creative solutions for our unique environment. The task force should ideally represent the following areas:

Type of organization	**Examples**
Local business: large employers; innovators and leaders	BayState Gas (Partners in Energy), Minute Maid
Economic development groups	Northampton Chamber of Commerce
Planning commissions	Pioneer Valley Planning Commission
City departments	Central Services, Planning, Board of Health
Members of the public and local organizations	Center for Ecological Technology
Regional interest groups and organizations	CT River Valley Greens, Hampshire Interfaith Environmental Taskforce, Northeast Sustainable Energy Corp., Sustainable Step New England
Educational Institutions	Smith College, Smith Vocational High School
City Council and appointed commissions	Northampton Energy Resources Commission

The Local Action Plan is a proposal for how the City can lead the community towards reducing energy use and greenhouse gas emissions in Northampton. It is comprised of varied projects and initiatives targeted at multiple sectors: municipal government, commercial and industrial businesses, residences, waste, and transportation. Both existing and potential programs to reduce emissions in every sector of the community and city operations are described in this report. Most of these measures have been successfully implemented in other communities across the country.

The municipal operations currently account for over 3% of the community's total CO_2 emissions. Measures taken to increase energy efficiency within City buildings will have a measurable impact of these emissions and a clear cost savings benefit. At the same time, the City can also promote community wide programs to reduce energy consumption and emissions. This includes both energy efficiency and changes in energy sources. Technology provides many opportunities to increase electrical, heating, and transportation efficiency. Policies can shift energy sources towards cleaner burning fuels and renewable energy. Incentive programs and public outreach can produce changes in behavior such as vehicle use, energy conservation, material purchasing, and waste disposal, helping the City to reach its emission reduction goal.

Local Action Plan

Listed below is a collection of current initiatives or capital improvement plans and proposed options for consideration to reduce greenhouse gas emissions in Northampton. The summary list below is followed by brief program descriptions. An effort has been made to give examples of CO_2 or eCO_2 (equivalent CO_2) reductions from other municipalities when possible. More research is needed to accurately estimate the results of each particular measure in terms of both emissions and finances.

Existing or Pending Measures

Current initiatives or capital improvement plans are included to measure efforts already underway to conserve energy or reduce waste. This list also recognizes programs with goals or priorities other than energy savings or waste reduction but nonetheless have greenhouse gas reduction benefits. Pending programs that are under discussion or develop have been included even if they are not yet implemented measures. Thus research and support of these programs may still be necessary to gain their expected greenhouse gas emission reductions. Some existing measures have the potential for **extensions** that would increase the programs effectiveness at reducing greenhouse gases.

Community Programs	**Department Responsible**
Energy	
No existing City programs	
Transportation	
Pedestrian Friendliness of Intersection & Squares	Planning/Pioneer Valley Planning Commission
Traffic Calming	Planning/Pioneer Valley Planning Commission
Bicycle Safety	Police
Rideshare Board	Planning
Designated Bike Lanes and Bike Routes	Planning
City Employee Carpool Program	Planning
Waste	
Methane Recovery	Board of Health

Municipal Programs	**Department Responsible**
Buildings	
City Building Lighting Retrofit	Central Services
City Building Heating and Cooling Efficiency	Central Services
Solar Panels on Northampton High School	Central Services
Vehicle Fleet	
Police Units on Bicycles	Police
Street Lights	
Street Lights Retrofit	Central Services
Waste	
Recycling in Municipal Buildings and Schools	Board of Health

New Proposals

Below is a wide range of initiatives to be considered for implementation. Many of the ideas listed below follow the example of other local government efforts to reduce emissions. Some are ideas unique to the energy or transportation needs and opportunities in Northampton. Measures marked with a "①" indicate recommended programs that can potentially be implemented within one year.

Community Programs	**Department Responsible**
Energy	
① Home Energy Conservation/Efficiency Program	Northampton Energy Resources Commission
① Develop Energy Efficient Building Code	City Council/Building Commission
① Climate Change Outreach and Education	Northampton Energy Resources Commission
① Block Purchasing of Green Energy	City Council/Central Services
Transportation	
① PVTA payroll purchase/discounts for City employees	Human Resources/Planning
Parking Cash Out	Planning
Tele-Commuting Option for City Employees	All departments
Waste	
Pay as You Throw Program	Board of Health
Curbside Recycling Collection	Board of Health
Methane Energy Conversion at Landfill Sites	Board of Health
Other	
① Sustainable Business Awards	Mayor's Office

Municipal Programs	**Department Responsible**
Buildings	
① Energy Efficient Office Equipment Procurement	Central Services
① Municipal Buildings Energy Efficiency Standards and Goals	Central Services
City Purchase of Clean/Green Energy	Northampton Energy Resources Commission
Energy Impact Report of all Improvement Plans	City Council/Central Services
Vehicle Fleet	
Downsize municipal fleet vehicles	All departments
Alternative Fuel Vehicle replacement of City fleet	All departments / DPW
Street Lights	
Retrofit traffic lights with LEDs	DPW
Waste	
Buy Recycled Paper Products	All departments

Community

Transportation

Increase Pedestrian Friendliness of City Centers & Intersections / Traffic Calming

Northampton benefits from the walkability of its commercial center. The City continues to promote this with well marked crosswalks, wide sidewalks, traffic signals prioritizing pedestrians, cross guards, and vehicle signage. However, vehicular traffic is on the rise, and other measures are being investigated to promote traffic calming. Traffic calming that reduces vehicular speed also reduces gasoline use and emissions. Pedestrian friendly areas promote walking, transit use, combined vehicular trips, and bicycle travel.

Pedestrian and Bicycle Safety

The Police Department has held safety programs to increase pedestrian and bicycle safety awareness in Northampton. These programs can increase public comfort with walking and bicycling to work, thereby reducing carbon dioxide emissions. A survey of people traveling by bicycle and by foot can show the effect that safety programs have on choice of transportation mode.

Rideshare Board

The Planning Department has supported the Route 9 TMA campaign to reduce traffic along Route 9. One of the programs undertaken by Route 9 TMA is an online community rideshare board, located on the University of Massachusetts website. Carpooling not only reduces greenhouse gas emissions, but it also reduces traffic congestion and improves air quality.

Designated Bike Lanes and Bike Routes / Increase Bike Facilities

The four greatest impediments for commuters choosing to bicycle to work are safety, weather, distance, and inadequate facilities for storage or changing at destinations. The city cannot control weather or people's commuting distance; however, bike lanes and racks encourage more bicycling in the city. Walking and biking are the only zero emissions forms of transportation. A study in Seattle found duel direction bike lanes on one street reduced VMT by 14,500 miles and eliminated 7 tons of eCO_2 annually. **Extension:** Northampton should connect existing bike lanes and/or paths (i.e., the Norwottuck Rail Trail) and continue to review dangerous intersections.

City Employee Carpool Program

The Planning Department is currently working on a rideshare board for city employees. With fairly consistent schedules, city employees can benefit from reduced commuting costs. If successful, this program can serve as a model for the community.

Waste

Methane Energy Recovery at Landfill Sites

Solid waste buried in landfills undergoes anaerobic decomposition. The decomposition of organic mater generates methane, a greenhouse gas with 21 times the potency of CO_2. The cap allows most all of the methane (75%) to be collected by central vents. It is estimated that the landfill currently generates approximately 585 tons of eCO_2. **Extension:** The city could build a facility that would convert this methane into an energy source that would power about 1,000 homes.

Municipal Programs

Buildings

Solar Hot Water and/or PV on Public Buildings

A photovoltaic panel was installed at Northampton High School. Schools are well suited for solar photovoltaic panels that contribute to the electrical grid using a high quality inverter, as their peak output would be during the summer vacation months. These panels can also be used to teach students about the importance of renewable energy. Central Services is also looking into improving the energy efficiency of the pool at JFK, possibly by installing solar hot water panels.

City Building Heating and Cooling Efficiency

Central Services has undertaken an evaluation of the school buildings for energy efficiency. Currently, the pool at JFK has been slated for retrofit. **Extension:** A commitment could be made by the City to use natural gas in dual boiler systems if natural gas prices are within 10% of heating oil prices.

Vehicle Fleet

Police Units on Bicycle

Many communities have found that police on bicycles provide a higher level of protection in certain areas. Moving police out of their cars and onto bikes reduces municipal fuel usage as well as saving capital costs. It also improves public relations with the police and provides visible evidence that bicycling is a legitimate option for transportation. Furthermore, it promotes officer health. Bicycle police can lead the city in establishing safe roads for cyclists. The city of Berkeley, roughly four times the size of Northampton, estimated an 8 ton reduction in eCO_2 from their police bike patrols.

Street Lights

Street Lighting Retrofit

Central Services has evaluated and retrofitted many of its streetlights to reduce energy consumption. **Extension:** Putting shields on streetlights reduces glare, energy demand, and light pollution. See www.darksky.org.

Waste

Recycling in City Buildings and Schools

Recycling has many environmental benefits. Specific to climate change and greenhouse gas concerns, waste diverted from landfills results in reductions of methane production. Recycling also results in energy savings in the manufacturing process. One ton of recycled paper saves 4077 KWH of energy.

Community

Energy

① Home Energy Conservation/Efficiency Program

The City could provide support/promotion of the conservation audit services provided by local utilities. More extensive conservation education programs could be offered by NERC together with the building department in the form of workshops or project consultation. Such services would be voluntary; however, energy audits and retrofits could be encouraged through permitting processes or design review.

① Energy Efficient Building Code

Currently, Northampton follows state building code regulations for quality, energy efficiency, and safety. The City could develop a regulatory or voluntary green building code (based on the LEED Green Building Rating System, for example) that would require enhanced energy efficiency design in all new structures or substantial additions. The Cities of Austin and Fort Collins have implemented a voluntary code that lays out very progressive parameters for sustainable design and construction. These cities offer training workshops in order to promote their green building code. The State of Oregon has written high-energy efficiency standards in its mandatory building code. Fort Collins, CO estimated a future savings of 1665 tons of eCO_2 from its voluntary green building program, in addition to long-term cost savings for residents and businesses.

① Climate Change Outreach and Education

Environmental education has become a greater influence in schools over the past ten years. The city could build additional curriculum resources that specifically discuss climate change issues with a focus on positive solutions for the future. Partnerships with local universities, governmental agencies and non-profits can provide links with science or policy experts as well as opportunities for experiential learning. Additional outreach to citizen and business would encourage more immediate behavior changes with regards to energy and vehicle use. This may include public displays, tabling at local events, continuous public forums, press coverage, and citizen participation in the CCP process.

① Block Purchasing of Green Energy

With the deregulation of electricity in Massachusetts consumers are free to change their electricity provider. One option communities have is to pool together their electricity needs and engage in block purchases in order to save money. Additionally, electricity providers will be able to sell green energy options that draw electricity from renewable energy resources. If City Council votes to implement municipal aggregation, city residents, business, as well as the government could build a block purchasing group to buy green power from a new energy provider as soon as next summer.

Transportation

① Public Transportation Discounts for City employees / On-site or Payroll Deduction Purchasing Option

Many public transportation companies offer means for employers to provided employees on-site or payroll deductions for purchasing monthly passes to encourage transit use. The payroll deduction option allows the pass to be paid before taxes, thus resulting in a 20-30% savings. Providing easy and more affordable access to transit passes for various members of the Northampton community

could reduce local VMT burdens. Similar operations could be undertaken at the high school or any local business employing more than 5 transit riders.

Tele-Commuting Option for City Hall Employees or Local Businesses
The city could provide the technology and the flexibility for certain employees to take advantage of telecommunication advances and reduce their number of trips to work. Each department would need to evaluate where this is possible. A program could also be implemented to encourage employers in Northampton to offer tele-commuting options.

Parking Cash Out
Many businesses offer free parking to their employees. Often this comes at a cost to the employer for leased spaces or parking facility maintenance. A parking cash out program would allow employees who use alternative means of transportation to work, to receive a portion of the cost it would have required to provide them with a parking space.

Waste
Curbside Compost and Recycling Pick Up
Recycling reduces greenhouse gas emissions and eases the demand for landfill space. Northampton already has a recycling rate of 44%. However, curbside programs can boost recycling rates as well as making recycling a visible part of community life. For example, the municipal curbside recycling program in Brookline, MA resulted in a 36% reduction of solid waste disposal and the savings of 17,819 tons of eCO_2 emissions in 1999.

Other
① Northampton Sustainable Business Awards
The economic development coordinator or building department could issue a certification or award to businesses that initiate emissions reductions activities. The criteria could include energy conservation, waste prevention and recycling, provision and procurement of environmental preferred products, use of low pollution technology, accessibility for bicycles, or development of employee VMT reduction program. If a business provides evidence that it has met a certain number of criteria, then they would gain promotion from the city through window displays, listings on Cities for Climate Protection materials and web space, or other subsidized advertising opportunities.

Municipal

Buildings
① Municipal Buildings Energy Efficiency Standards
Northampton can set minimum standards for the energy efficiency of its own buildings. The city of Tucson established efficiency standards for all new buildings at 50% higher than federal requirements. Such standards could apply to other buildings as well. For existing structures, the City should set a reduction goal for energy use to encourage continued efficiency and conservation efforts. Fort Collins set a 15% energy reduction goals for all of its city owned buildings.

City Purchase of Clean/Green Energy
Although it is not available currently, the City will be able to buy green electricity cheaply if it opts for municipal aggregation. The bulk purchasing of electricity can bring electrical cost down for large purchasing orders. The City of Northampton could translate some of this savings to making green energy purchases that will greatly reduce the CO_2 emissions of municipal electrical use. The

deregulation allows local governments to offer residents and businesses the opportunity to join the city in block purchases of green power. This could bring the collective cost of energy lower for the city and residential or commercial consumers while investing in new clean energy technologies. The CO_2 coefficient and other emissions of this power supply should be investigated.

Vehicle Fleet

Downsize Municipal Fleet Vehicles

Municipal vehicles should be purchased with the true fleet vehicle needs of the department. Downsizing the fleet means reducing unnecessary fleet numbers as well as reducing vehicle size for energy and cost savings. ICLEI estimates that vehicle downsizing from light trucks or sedans to compact cars can result in 2.5 to 6.5 tons of CO_2 reduction per vehicle. More efficient vehicles should be phased in as older vehicles need replacement rather than replacing vehicles before their usable life span is complete.

Alternative Fuel Vehicle Replacement / Conversion of City Fleet

The state has mandated that almost all state agencies begin purchasing alternation fuel vehicles for their fleet in the upcoming years. Alternative fuels include; compressed natural gas (CNG), hybrid engines that use a combination of gasoline and electrical engines, and electric vehicles. The DPW yard could potentially be a location for a CNG fueling station. The vehicle fleet should be evaluated so as older vehicles are retired, departments can begin choosing alternative fuels for their new cars and trucks. Additionally, large diesel vehicles can be converted to run on compressed natural gas or be used as duel fuel vehicles. The City may also consider establishing an alternative vehicle trial program to explore the use of electricity, hybrid, or in the future, fuel cell vehicles.

Street Lights

LED Traffic Signals

In 2000, traffic signals used 147,101 kWh of electricity at a total cost of $16,271 to operate. LED lights use 80-90% less energy than incandescent bulbs. A study in Sacramento, CA found 87% energy savings at one intersection where red, green, and pedestrian lights were converted to LED. LED lights also require 1/6 the maintenance of incandescent bulbs, often needing replacement only every 8-10 years. The energy savings from the installation in Northampton could produce a 75% reduction in energy use at each signal, resulting in an energy savings of 110,000 kWh of electricity, a CO2 reduction of 80 tons, and a cost savings of $10,000 to $13,000 annually.

Waste

Purchase of Recycled Paper Products

The key to promoting the growth recycling of the recycling industry is the purchase of recycled products. Recycled paper results in 74% less air pollution and 64% less energy use to manufacture than paper from wood. Incurring only slightly more expense, the City can buy paper with at least 25% recycled content for municipal usage.

Appendix A: Data Contacts and Resources

Community Inventory Data Sources

Electricity:
Center for Ecological Technology
Nancy Nylen — Nancy.A.Nylen@williams.edu

Natural Gas:
BayState Gas
Brian Errante — 413.781.9200 x2212

Heating Oil:
City government

Joan Sarafin	Assessor's Office	587.1202
James Thompson	Planning	587.1285

MISER
Report 92-11: Housing Characteristics — 545.3460

Transportation:
Capitol District Transportation Committee
Chris O'Neil — 518.459.2155

Pioneer Valley Planning Commission
Dana Roscoe — 781.6045

Solid Waste:
City government

Karen Bouquillon	Board of Health	587.1284
Peter McErlain	Board of Health	587.1213

Web Resources for Data:

Demographic and Heating Degree Days Data
www.umass.edu/miser
www.detma.org/lmi/local/Northamp.html
http://www.detma.org/MassStats/websaras/frame_it.asp?theProductName=MassStats
http://www.monstermoving.com/Find_a_Place/Compare2Cities/results.asp?srcCity=822&dtnCity=855

Heating Oil, Propane, Kerosene, Wood, and Solar
www.eia.doe.gov/emeu.sep/ma/consum/rc.htm
www.eia.doe.gov/emeu.sep/ma/consum/cc.htm
www.eia.doe.gov/emeu.sep/ma/consum/ic.htm

City of Northampton Municipal Inventory Data Sources

Buildings

Lisa Rehbein	DPW	587.1571
Susan Stone	Central Services	587.1245
Ray Ellerbrook	Recreation Department	587.1043
Regina Drozdal	School Department	587.1325
Bob Magrone	MECO	508.357.4574
Ann Laborante	WMECO	787.9273

Vehicle Fleet

Laura Brzys	DPW	587.1571
Laura Krutzler	Fire Department	587.1032
John Carver	Flood Control	587.1093

Street Lights

Susan Stone	Central Services	587.1245

Solid Waste

Karen Bouquillon	Board of Health	587.1284